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Evaluating Situation Awareness in the Nurse Anesthesia Trainee During High Fidelity Simulation

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Abstract

Nurse anesthetists provide anesthesia care for patients within a complex and dynamic environment. Errors and adverse events during anesthesia have declined greatly over the decades, yet when errors occur they are devastating. Anesthesia providers must train for adverse events and develop skills to provide excellent care to patients. Situation awareness skills are proven to advance safety in other complex, dynamic professions, whereas situation awareness training and research is newly evolving in anesthesia.

A situation awareness seminar was developed from a review of relevant literature. A mixed methods research design was utilized for this pilot study. Nurse anesthesia trainees (NATs) were recruited and divided into two groups. Group A received the situation awareness seminar and then participated in a high fidelity simulation where their situation awareness skills were scored. Group B participated in a high fidelity simulation where their situation awareness skills were scored and then attended the situation awareness seminar.

Results of the Situation Awareness Global Assessment Technique survey did not appreciate a statistically significant difference between the groups. However, questions relating to perception were most frequently missed, indicating an area for future situation awareness training. Additionally, post assessment acceptability survey questions scored high means, with narrow standard deviations indicating favorability of the seminar and simulation by NATs. The favorable responses on the Acceptability survey and the correlation of findings with other research on situation awareness in nursing demonstrate that this study design is sustainable and feasible on a larger scale. Keywords: situation awareness, nurse anesthesia trainees, high fidelity simulation
Chapter 1. Introduction

A Certified Registered Nurse Anesthetist (CRNA) has an advanced practice nursing degree, either a master’s or doctorate in nursing (American Association of Nurse Anesthetists [AANA], 2013). The prerequisites for entry into a CRNA program typically include a bachelor’s degree in nursing, a high GPA, high GRE scores and at least one year of nursing experience in an intensive care unit (ICU) (AANA, 2014). With these prerequisites, Nurse Anesthesia Trainees (NATs) are at least competent; perhaps even proficient or experts, in the field of critical care nursing but become novice nurse anesthesia trainees upon entry into the CRNA program. (Benner, 2001)

The transition from proficient critical care nurse to a novice NAT is very unnerving. Previously as ICU nurses, NATs made high-level clinical decisions, within a complex and dynamic environment, incorporating advanced pathophysiology and patient specific factors. In the role of a novice anesthesia provider, NATs are task oriented, unable to make clinical decisions on their own, and may not perceive the entire clinical picture (Benner, 2001). Being a novice in anesthesia at the beginning of the NATs anesthesia educational journey is expected. The development of NATs from the novice level towards becoming experts in the field of nurse anesthesia is fostered through the rigorous didactic and clinical aspects of CRNA programs.

Other than intense knowledge and skill acquisition, how can the NAT expedite the process of going from anesthesia novice, to beginner, to advanced beginner, to competent, to proficient, to expert in nurse anesthesia? The answer may involve incorporating a theory developed in the human factors specialty called situation awareness (SA).

The development and level of one’s SA can greatly influence the quality of a patient’s outcome (Wright & Fallacaro, 2011). The use of high fidelity patient simulation scenarios offers
NATs the opportunity to develop situation awareness (Wright & Fallacaro, 2011). According to Schulz, Endsley, Kochs, Gelb, and Wagner (2013), focused training on situation awareness can provide an improved ability to develop SA, therefore leading to enhanced performance and patient care.

**Background and Significance**

**Situation awareness.** Endsley (1988) first defined situation awareness as the “perception of the elements of the environment within a volume of time and space, the comprehension of their meaning and the projection of their status in the near future” (Endsley, 1988, p.97). There are three hierarchical levels of situation awareness: Level 1 is Perception, Level 2 is Comprehension, and Level 3 is Projection (Endsley, 1995). An example of situation awareness Level 1 in anesthesia would be the collection of data such as the patient’s vital signs, appearance of the patient and through communication with the surgical team (Schulz, Endsley, Kochs, Gelb & Wagner, 2013). Situation awareness Level 2 in anesthesia pertains to understanding the patient data and how it affects what is happening at that time (Schulz et al., 2013). Situation awareness Level 3 in anesthesia incorporates the understanding of the patient’s status, anticipating future events and preparing for early intervention (Schulz et al., 2013).

Many disciplines incorporate situation awareness into their practice including aviation, the military, fire science and, more recently, nursing and anesthesia. Aviation and anesthesia are often compared to one another because both specialties involve complex, dynamic, high-risk decision making by the pilot or anesthesia provider during takeoff (aviation) or induction (anesthesia), maintenance (aviation and anesthesia) and landing (aviation) or emergence (anesthesia). There is data to support the success of situation awareness in the field of aviation, yet the data regarding situation awareness in the field of anesthesia is limited and newly evolving.
(Wright and Fallacaro, 2011). Despite the similarities in complexity of systems, the aviation industry has far exceeded the healthcare industry in safety excellence.

**Anesthesia safety.** At the turn of the century, the Institute of Medicine examined healthcare safety. According to Kohn, Corrigan, and Donaldson (2000), there were as many as 98,000 preventable deaths in hospitals per year due to medical errors. Kohn et al. (2000) defined medical errors as “the failure of a planned action to be completed as intended or the use of the wrong plan to achieve an aim.” The Institute of Medicine (IOM) developed a strategy to help decrease preventable medical errors (Kohn, Corrigan & Donaldson, 2000). The IOM recognized that medical errors were not the result of carelessness by an individual or group, but that mistakes were more commonly caused by “faulty systems, processes, and conditions that lead people to make mistakes or fail to prevent them” (Kohn et al., 2000). While the IOM report examined healthcare as a whole, the specialty of anesthesia has similar research findings.

A retrospective study conducted by Cooper, Newbower, Long, and McPeek (2002), examined 359 preventable mishaps that occurred among 47 anesthesiologists and residents. The researchers concluded that 82% of the errors were due to human error while only 14% were due to equipment failures (Cooper et al., 2002). Despite the common consensus that induction and emergence carry the most potential for error, almost half of the errors discussed in the study occurred during the maintenance period (Cooper et al., 2002). Some of the most commonly occurring errors included breathing circuit disconnect, inadvertent gas flow change, syringe swap, and gas supply issues (Cooper et al., 2002). The results of this study are alarming and necessitate further research and implementation of new training methods for anesthetists to prevent and/or reduce anesthesia related errors.
According to Wright and Fallacaro (2011), anesthesia related errors have declined over the past twenty years but when errors do occur, they are usually devastating. While a decrease in anesthesia errors is undoubtedly a positive, this decrease in errors reduces the amount of real life experience NATs have in managing critical events. Therefore, NATs need simulation training focused on responding to critical events in order to develop their SA and decision-making skills (Wright & Fallacaro, 2011). According to Wright, Taekman, & Endsley (2004), simulation provides an environment where infrequent adverse patient events can be practiced, thus improving the training of future practitioners.

Gaba, Howard, and Small (1995) stated that similar to the field of aviation, simulation has been paramount to the study of situation awareness in anesthesia. Simulation scenarios allow for problems and issues to be inserted into an otherwise standard clinical situation. The fidelity of these clinical simulations is attributed to the simulator’s advanced physiologic and pharmacologic capabilities (Gaba, Howard, & Small, 1995). Together, simulation training and experience advances the anesthetist’s expertise in anesthesia related critical events, ultimately aimed at improving situation awareness and improving patient care.

In anesthesia, critical thinking and decision-making skills are essential to the safety of the patient. The environment in which an anesthetist operates encompasses many complex factors that have the potential to change at any time, warranting the importance of situation awareness. Being a proficient, anesthetist is paramount for critical thinking and decision-making skills that are essential to the safety of the patient.

**Situation awareness errors and anesthesia.** Schulz et al. (2013) describes situation awareness errors specific to anesthesia on each of the three levels. SA Level 1- Perception errors occur when the anesthetist fails to perceive information or has inaccurate perception of
information (Schulz et al., 2013). Level 1 errors in anesthesia can occur from visual/auditory
barriers, a failure of the system to make information available, information made available but
not attended to, or when the perceived value does not represent reality (Schulz et al., 2013).

SA Level 2 - Comprehension errors occur when the perception is not integrated or
understood completely (Schulz et al., 2013). Level 2 errors occur when the anesthetist is missing
or chooses the wrong mental model for a situation. An example of a level 2 error is
misdiagnosis (Schulz et al., 2013). Level 2 errors can also occur when the situation is new to the anesthetist
because the individual cannot comprehend the information fast enough for a situation they have
never experienced (Schulz et al., 2013).

SA Level 3 - Projection occurs when the prediction of future events is incomplete or
inaccurate despite a full understanding of the current situation (Schulz et al., 2013). An example
of a Level 3 error in anesthesia could be not having blood products on hold for an operation that
is known to have massive bleeding. Schulz et al. (2013) suggest that the first steps in training
situation awareness skills in anesthetists include education on the concept of situation awareness
and how errors in anesthesia occur due to incomplete situation awareness. Errors can occur an
all 3 levels of situation awareness; perception, comprehension, and projection.

The theory of situation awareness has the potential to benefit anesthesia providers to
prevent errors, therefore, providing improved care for patients. SA has been linked to one’s
performance, level of expertise, and the foundation decision-making; therefore, insufficient SA
in a provider may lead to errors (Klein, 2000). Situation awareness is an important skill to
develop as an anesthesia provider.

**Problem Statement**
Currently, education or training on situation awareness is not incorporated in the didactic curriculum at NorthShore University HealthSystem School of Nurse Anesthesia.

**Purpose of the Project**

The purpose of this pilot study was to 1) Examine the difference in the level of the situation awareness (SA) among Nurse Anesthesia Trainees (NATs) who attend a SA seminar compared to the SA of those NATs who did not attend a SA seminar and to 2) Examine the acceptability of the seminar on situation awareness by NATs.

**Clinical Question**

Schulz et al. (2013) suggest that the first steps in training situation awareness skills to anesthetists are educating anesthetists on the concept of situation awareness and how errors in anesthesia occur due to incomplete situation awareness. Therefore, the following clinical questions were addressed in this study.

- Was there a difference in situation awareness during high fidelity simulation between NATs who attended a SA seminar and NATs who did not?
- How did NATs perceive the situation awareness seminar?

**Theoretical Framework**

The theoretical framework for this study was based on the three level situation awareness (SA) model, which includes Level 1 SA- Perception, Level 2 SA- Comprehension and Level 3 SA- Projection (Endsley, 2006). Level 1 involves perception of relevant information from the environment via visual, auditory, olfactory and tactile input (Endsley, 2006). Lack of perception dramatically increases the likelihood of not forming the correct picture of the situation (Endsley, 2006). In complex and dynamic environments, such as anesthesia, novices can have extreme
difficulty in acquiring information and deciding what information is important or not (Endsley, 2006). Excellent Level 1 SA is extremely important for error prevention.

Level 2 SA- Comprehension builds upon Level 1 SA- Perception. In addition to perceiving information in complex, dynamic systems, the operator must also have an understanding of the information’s meaning and significance (Endsley, 2006). Level 2 SA- Comprehension includes how operators combine, interpret, store and retain information (Endsley, 2006). Endsley (2006) compares Level 1 SA and Level 2 SA to reading. Level 1 SA- Perception of information is analogous to individual words and Level 2 SA- Comprehension is analogous to understanding of the meaning of sentences and paragraphs.

Achieving Level 3 SA- Projection is the highest level of understanding of the situation (Endsley, 2006). Level 3 SA- Projection involves the ability to predict future events from the Level 1 SA and Level 2 SA to make clinical decisions in a timely matter (Endsley, 2006). The novice operator of dynamic, complex systems struggle to even gather all information, let alone have comprehension or prediction of the situation (Endsley, 2006). The expert operator has situation awareness skills that allow for fast and effortless perception, complete comprehension, and accurate prediction.

Schulz et al. (2013) created a framework based on their review of literature, specifically the work of Endsley (1995), Endsley (2006) and Gaba et al. (1995), to illustrated how SA influences an anesthetist’s clinical performance. Included in Schulz et al. (2013) framework (Figure 1) were the following concepts which support an anesthetist’s level of SA: capacity, working memory, goal-driven processing alternating with data-driven processing, expectation, mental models, pattern matching, automaticity, and learned skills. Schulz et al. (2013) defined these concepts as follows:
Capacity refers to the anesthetist’s limited ability to focus on all relevant information at hand (Schulz et al., 2013). Working memory is necessary for storage, integration and processing of observed information and to continuously appraise the mental model of the current situation (Schulz et al., 2013). As the capacity of the working memory is surpassed, important information may be forgotten or improperly incorporated into development of higher level SA (Schulz et al., 2013).

Goal-driven processing involves a top-down course the anesthetist uses to direct their attention to necessary aspects in order to achieve the goal of “ideal state of the patient” (Schulz et al., 2013). Data-driven, bottom-up processing, however, involves surveying all relevant information and adjusting the course of action or goal depending on significant information gathered (Schulz et al., 2013). Endsley found the cycle of goal-driven and data-driven processing to be a crucial aspect of SA.

Schulz et al. (2013) defined expectations, right or wrong, as affecting the visual search for information and perception of found information. Mental models, part of the long-term memory aiding in bypassing the restrictions of the working memory, include cognitive mechanisms for interpretation and projection of events in complicated domains (Schulz et al., 2013). Therefore, a mental model allows a provider to have knowledge of several differential diagnoses pertaining to a specific problem, such as hypotension, with its characteristic signs. For example, when assessing a patient with hypotension, the provider uses mental models of blood loss or hypovolemia as potential causes to quickly diagnose the cause of hypotension.

Pattern matching involves a faster development of SA in a critical situation due to information being recalled from a previous similar event (Schulz et al., 2013). For example, if a patient is not breathing after the endotracheal tube is removed and the NAT had been involved in
a similar situation previously, the NAT can more rapidly recognize the event as a laryngospasm and respond appropriately. Automaticity involves freeing up the working memory and allowing attention to be placed elsewhere when performing a repetitive physical or cognitive task (Schulz et al., 2013). Finally, learned skills are field specific skills taught to aid in the development of SA (Schulz et al., 2013). Incorporating these concepts, Schulz et al. (2013) developed a framework of the anesthetist’s situation awareness (Figure 1), which was adapted from the situation awareness frameworks of Endsley (1995) and Gaba et al. (1995).

The Schulz et al. (2013) framework of the anesthetist’s situation awareness (SA) (Fig. 1) illustrates that SA directly influences an anesthetist’s decision-making and therefore task management, teamwork and performance. In this framework, Level 1 SA-Perception is determined by sensory input and how attention is distributed (Schulz et al., 2013). The higher levels of SA, Level 2 SA- Comprehension and Level 3 SA- Projection, are achieved by incorporating information from long term memory such as medical guidelines, therapy goals, automaticity, mental models, medical knowledge, and pattern matching (Schulz et al., 2013). Also, higher levels of SA are achieved with working memory skills to constantly update the perceived information as the situation changes over time (Schulz et al., 2013). The theoretical framework of the anesthetist’s situation awareness was used to guide the development of a situation awareness seminar.

Chapter 2. Literature Review

The aim of this literature review is to critically review the literature on the concept of situation awareness.

Objectives
(1) Review the literature specific to the focus population, nurse anesthesia trainees, and situation awareness; (2) identify concepts of situation awareness in nursing and/or anesthesia (3) identify how the skill of situation awareness is used by nurses and/or anesthetists; (4) identify published accounts of what influences obtaining situation awareness in nurses and/or anesthetist; and (5) identify themes of how to improve situation awareness in our focus population.

Search Methods

The search included two databases: PubMed, and CINAHL. Keywords and their Boolean combinations included: situation awareness or situational awareness, nurse or nursing, anesthesia or anesthetist. The results were refined by: English language studies only, peer-reviewed journals, and primary qualitative & quantitative studies.

Search Outcome

The initial search results produced 20 articles from PubMed and 27 articles from CINAHL. Articles were excluded based on the following: studies examining team situation awareness (as opposed to individual situation awareness), and studies examining how technology, such as integrated video displays, influence situation awareness. Exclusions were made based on first evaluating the title, followed by abstract and finally, full-text. After eliminating articles based on exclusion criteria, 12 articles from PubMed and 18 articles from CINAHL were included, for a total of 30 research articles. Of these remaining articles, four were duplicates. Therefore, 26 articles met the primary investigators’ objectives for this literature review.

Concept of Situation Awareness

Concept in anesthesia. Gaba et al. (1995) were the first to formally introduce the concept of situation awareness in anesthesia by reviewing the current literature on SA in aviation
and highlighting the potential for its utilization in anesthesia. Furthermore, Gaba et al. (1995) were the first to question if situation awareness skills could be taught to anesthetists. If so, anesthetists, both novice and experienced, would benefit from learning how to practice situation awareness skills while navigating the dynamic work environment of providing anesthesia (Gaba et al., 1995). Furthermore, situation awareness education may help anesthetists apply their extensive anesthesia science knowledge and previous case experiences to current situations (Gaba et al., 1995).

Recommendations by Gaba et al (1995) to help anesthetists develop level 1 SA include: practice in scanning instruments and the environment, the use of checklists to minimize distractions, training in the allocation of attention in both low fidelity and high fidelity simulation, training on pattern matching of known disease and conditions (Gaba et al, 1995). Together, these skills will enhance the situation awareness of the anesthetist.

**Concept in nursing.** Sitterding, Broome, Everett and Ebright (2012) analyzed the concept of situation awareness in nursing work and based their research on situation awareness on the previous work done by Endsley. Sitterding et al. (2012) found that situation awareness errors are influenced by working memory, expertise, distractions, and cognitive workload. Alarmingly, Sitterding et al. (2012) discovered that the majority of SA errors occur at the level of perception, despite the fact that it is the most basic level. In Level 2 SA- Comprehension, the individual incorporates the perceived situation to prioritize tasks, which in turn influence performance (Sitterding et al., 2012). Level 3 SA- Projection is the highest level of SA and in nursing would include the ability to forecast an impending patient decline (Sitterding et al., 2012).
By adapting Endsley's definition and incorporating nursing theory, Sitterding et al. (2012) created a working definition of situation awareness in acute care nursing as “... the nurse’s perception of relevant clinical cues related to the patient and his or her environment; the comprehension of the meaning and sense of salience about those cues; and the anticipated projection of required intervention based on those cues” (p. 83). After defining situation awareness in acute care nursing, Sitterding et al. (2012) conducted fieldwork to form a theoretical framework of situation awareness in acute care nursing. By interviewing 15 acute care nurses on a recent experience when a patient was crashing, Sitterding et al. (2012) identified themes of situation awareness (SA) that emerged while nurses cared for patients during critical events. From these interviews, Sitterding et al. (2012) identified five themes: SA and expertise, SA and cognitive overload, SA and interruption management, SA and task management and SA and cognitive stacking. From the fieldwork and literature review, Sitterding et al. (2012) ascertained that SA is a concept significant and applicable to acute care nursing.

Utilization of Situation Awareness

Many nursing studies have demonstrated that nurses incorporate situation awareness skills into their practice. For example, Tower and Chaboyer (2014) found that nurses utilize all three levels of situation awareness in the decision making process. Sitterding, Ebright, Broome, Patterson and Wuchner (2014) identified that nurses used situation awareness skills during medication handling. Additionally, situation awareness is one of the non-technical skills essential for ICU nurses to provide safe care (Reader, Flin, Lauche, & Cuthbertson, 2006). Tower, Chaboyer, Green, Dyer and Walls (2012) found that nurses used mental models for decision-making and the cues nurses used to direct patient assessments demonstrated all three levels of
situation awareness. Therefore, the concept of situation awareness applies to the field of nursing and is important to patient care.

Situation Awareness skills are useful during all aspects of nurse anesthesia care, including reporting off to other providers. Wright (2013) discussed the importance of safe and effective report of pertinent patient information when care is transferred from one anesthesia provider to another. Wright (2013) explained that preventable accidents occurred when there was a lack of situation awareness and therefore implemented a communication checklist (PATIENT) with which to use during handoff. Therefore, patient safety can be maintained in a constantly evolving environment while improving situation awareness (Wright, 2013).

Bogossian et al. (2014) assessed nursing student’s situation awareness while managing a deteriorating patient during high fidelity simulation. Unfortunately, the nursing student’s situation awareness scores were low (41%) and below the expectations of experienced nurses (Bogossian et al., 2014). This finding supports the need for situation awareness training for nursing to safely manage critical patient events.

The use of high fidelity patient simulation scenarios provides NATs with the opportunity to gain experience with non-routine and critical events that may not otherwise arise in the clinical setting (Wright and Fallacaro, 2011). Providing NATs with simulation experiences allows the students to develop critical thinking skills and situation awareness during stressful situations while in a controlled environment (Wright & Fallacaro, 2011). Therefore, when a critical event occurs in the clinical setting, NATs will be better prepared to respond appropriately and safely (Wright & Fallacaro, 2011). Niak and Brien (2012), also find simulation based training to be beneficial as NATs gain exposure and learn skills necessary to provide care in a clinical situation. Simulation provides NATs with a standardized clinical scenario and allows
continued practice without causing harm to a patient (Niak & Brien, 2012). The use of simulation education offers a safe method to assess and teach technical and non-technical skills such as situation awareness in the student (Niak & Brien, 2012).

**Influences on Situation Awareness**

Anesthetists achieve Level 1 SA- Perception by being aware of the patient’s heart rate, blood pressure, oxygen saturation, breathing rate, medication history, level of consciousness and laboratory values (Wright, Tackman & Endsley, 2004). Additionally, the anesthetist must be aware of actions of other members of the surgical team and equipment functioning. (Wright et al., 2004) For Level 2 SA- Comprehension, the anesthetist must synthesize all the separate aspects of Level 1 SA- Perception. For example, from all relevant patient cues, the anesthetist formulates the most probable cause of a decrease in heart rate and knows if this decrease is an expected and temporary event or a serious problem (Wright et al, 2004). Level 3 SA- Projection incorporates all levels of SA and the anesthetist with this highest degree of SA will be able to, for example, predict the response of the vital signs to drug administration (Wright et al., 2004).

Situation awareness is vital pre, intra, and postoperatively as each area of the operative experience carries its own risk (Fioratou, Flin, Glavin, & Patey, 2010). Fioratou et al. (2010) described a distributed approach to situation awareness (DSA) as a continuously, changing dynamic between the environment and the anesthetist as opposed to solely focusing on the mind of the anesthetist. DSA is formed through the integration of the anesthetist’s own knowledge and the knowledge of the environment and patient to develop an integrated picture of the situation at hand (Fioratou et al., 2010). The overall goal of DSA is to provide an all-encompassing understanding of intraoperative events and how these promote or deter the anesthetist’s practice (Fioratou et al., 2010). Fioratou et al. (2010) stated that “providing and training for corrective
protocols would be a better strategy in improving SA, avoid fixation errors, and improve patient safety” (p. 88).

In order to develop situation skills, the individual must also learn how to avoid the lack of situation awareness. For example, Flin, Fioratou, Frerk, Trotter & Cook (2013) interviewed anesthetists involved in adverse events associated with airway management and found that the most common situation awareness errors included incorrect judgment and failure to predict. Reviewing how lack of situation awareness leads to errors illustrates how to obtain situation awareness skills.

Themes for Improving Situation Awareness

The issue of patient safety affects all aspects of anesthesia. Thus, it is important to begin by providing novice providers with the skills to deliver safer patient care. Developing situation awareness skills during high fidelity simulation will provide opportunities for NATs to develop critical thinking and decision-making skills during real life patient care scenarios. The cost of not fixing the problem is the continued high percentage of human medical errors in anesthesia. It would not be realistic to believe all human error will be remedied, but the implementation of training methods through the use of human factors theory of situation awareness could be successful (Cooper et al., 2002).

One theme identified is the need for situation awareness education for student anesthetists and nurses. For example, Yee et al. (2005) found that there was significant improvement in nontechnical skills, such as situation awareness, between the first and second session of high fidelity simulation. Furthermore, Wright and Fallacaro (2011) found that situation awareness scores during WOMBAT-CS computer based examination of SA varied greatly between Student Registered Nurse Anesthetists and the only correlation measurement with explained variance of
SA was cognition. Therefore, Wright and Fallacaro (2011) called for further research on SA of NATs during high fidelity simulation and concluded that faculty of nurse anesthesia programs should educate NATs on SA.

McKenna et al. (2014) found that SA was low (41%) in senior nursing student’s management of simulated patient deterioration. Additionally, McKenna et al. (2014) found that level 1 SA- Perception was lowest (26%) while level 3 SA- Projection was the highest (59%) of nursing students during this simulation. Thus, McKenna et al. (2014) suggested that nursing educators needed to incorporate SA education into the curriculum. Overall, the findings of this literature review support the need for further research on the effect of education on SA for NATs.

Chapter III: Methods

Research Design

A mixed methods research design was utilized for this pilot study. A quasi-experimental design examined the difference in situation awareness in NATs who received a seminar on situation awareness prior to a high fidelity simulation scenario compared to NATs who received a seminar on situation awareness after completing the simulation. A descriptive design examined the NATs acceptability and perception of the situation awareness seminar through a Likert-scale scoring survey. This research design was chosen because it allowed the researchers to determine if there was a difference between the two groups and if the NATs may incorporate the theory of situation awareness into their practice.

Sample Population

This project used a convenience sample as a method to recruit the participants. The target population was NATs from the Class of 2017, enrolled at NorthShore University HealthSystem
School of Nurse Anesthesia (NSUHSSNA), and consisted of 20 NATs, 16 females and 4 males.). Inclusion criteria comprised registered nurses with a bachelor's degree and at least one year of critical care nursing experience. Exclusion criteria included anyone who graduated from an anesthesia program, and anesthesia residents.

Setting

The setting was at the GCSI at NorthShore University HealthSystem in Evanston, Illinois. The GCSI has High Fidelity Patient Simulation that is used for medical, nursing and surgical specialties for the purposes of education, training and research. The GCSI provided the setting of a simulated operating room environment, complete with high fidelity SimMan. To avoid inconveniencing the study participants, the GCSI was scheduled for December 14th, 2015, a date that the target population was already scheduled to be at Evanston Hospital so that the study could immediately follow the participant’s scheduled class time.

Project Description and Timeframe

Prior to submitting to the NorthShore University HealthSystem Institutional Review Board (IRB), the investigators presented the DNP project to the Nursing Research Council. In addition, a signature of approval was needed from the Chief Nursing Officer Nancy Semerdjian, RN, CNO at NorthShore University Health System after which, the investigators submitted the IRB paperwork. Approval from the NorthShore University HealthSystem IRB was received on November 5th, 2015 as exempt status followed by approval from DePaul University on November 10th, 2015 as exempt status. The approval letters can be found in Appendix F.

After receiving approval from the Institutional Review Board (IRB), the sample population was contacted via email to participate in this study. Julia Feczko CRNA, DNP, faculty member at NorthShore University HealthSystem School of Nurse Anesthesia, emailed
the Recruitment Email and Information Sheet for Participation in Research Study (Appendix A) on November 29th, 2015. The Recruitment Email also informed the NATs that they would need to provide consent for participation in this research study. A copy of the consent form used can be found in Appendix G. The investigators had no contact information for the study participants. The Recruitment Email and Information for Participation in Research Study explained the nature of the study and the de-identified and voluntary nature of their participation. No audio or videotaping took place and no identifiers were collected.

On December 14th, 2015, immediately following the conclusion of lecture, the primary investigators entered the classroom to obtain consent from the NATs in the Class of 2017 at NSUHSSNA. Ten NATs were present. The primary investigators handed out the consent forms (Appendix G) and fielded questions. The NATs inquired about the amount of time they would need to commit to complete the study. The investigators explained that they limited the situation awareness seminar to approximately 30 minutes and each individual simulation to 8 minutes. For ethics purposes, neither the situation awareness seminar nor the simulation scenarios could occur during actual class time. The primary investigators informed the NATs that if they chose not to consent to participation, they were still invited to attend the situation awareness seminar so that they would not be excluded from the learning opportunity. The participants were reminded that they were permitted exit the seminar or simulation at any time without any consequences.

After answering all of the NATs questions, two decided not to participate. The remaining eight NATs consented for participation and then they picked a number. Even numbers (2, 4, 6, 8) were assigned group A, while odd numbers (1, 3, 5, 7) were assigned group B.

Group A received the situation awareness seminar prior to the high fidelity patient simulation; Group B received the situation awareness seminar after the simulation. A
hypotensive patient scenario was selected because all of the participants have had at least 2 years of intensive care nursing experience and therefore will have prior experience in treating hypotension. Prior to the simulation scenario in both groups, the participants received a pre briefing of the simulation including a brief report on the patient and that there would be a series of questions following the conclusion of the simulation. The participants were assured that there were no right or wrong answers in both the simulation and questioning that would follow the simulation (Appendix E). Please see Appendix D for the Timeline of Events. All data was collected on one day, December 14th, 2015, and then analyzed.

**Evaluation Plans**

**Hypotension Situation Awareness: SAGAT Tool Development.** The tool used to measure each subject’s SA was the Situation Awareness Global Assessment Technique (SAGAT). Endsley (2000) developed the Situation Awareness Global Assessment Technique. SAGAT has been found to be a reliable, valid tool for assessing SA in the airline industry (Endsley, 2000). To the primary investigator’s knowledge, the validity and reliability of SAGAT had not been empirically proven in nurse anesthesia research. However, Schulz et al. (2013) concluded that SAGAT has been validated as a direct and objective SA measure in various domains including medicine. The SAGAT technique guidelines were also used by Hogan, Pace, Hapgood, and Boone (2006) to create their Trauma SAGAT tool which had an analysis of variance equal to $p<0.001$ and a Cronbach’s alpha of 0.767. Due to its proven validity and reliability, the primary investigators chose to adapt this tool for use in this project because it was deemed the best way to measure SA in nurse anesthesia simulations. The investigators adapted the Hogan et al. (2006) tool to create the Hypotension Situation Awareness: Situation Awareness Global Assessment Technique questions (Appendix C).
**Situation Awareness Global Assessment Technique (SAGAT) Background.** The Situation Awareness Global Assessment Technique provides direct measure of SA in subjects during a simulation (Endsley, 2000). The simulation of interest is randomly frozen at selected times (Endsley, 2000), then subjects are asked to quickly answer questions about their perceptions of the simulation without access to other information. The time when the simulation is frozen is not random but the events occurring in the simulation are random. For example, if the information is normally projected on a computer, the computer screen will turn black or the subject could be asked to turn around with attention directed away from the simulation.

In order for the SAGAT tool to be considered global, the subject must be asked questions that pertain to each level of SA including perception, comprehension, and projection. Additionally, a global assessment involves questions about system functioning and relevant features of the external environment (Endsley, 2000). In developing a SAGAT tool for this research the investigators defined the system of the simulation (the patient) and defined relevant features of the external environment (such as vital sign trends, blood loss in the surgical field, patient history, surgical procedure, and communication with the surgical team). The investigators followed Endsley’s (2000) specific guidelines for the development of the questions of this research study because Hogan et al. (2006) followed these guidelines in creating their valid and reliable SAGAT tool.

Endsley’s (2000) guidelines included that the questions must be relevant to the subject’s SA, asked in a cognitively compatible manner and from a goal directed task analysis. An example of a question relevant to the subject’s SA during an anesthesia simulation would be about the patient while a question irrelevant to the subject’s SA would be asking what is the surgeon's eye color. Endsley (2000) explained that a cognitively compatible manner is when the
question is phrased in a way that the subject thinks and does not require extra transformations or decisions by the operator. Since the primary investigators were also NATs who have been involved in many anesthesia focused simulation experiences in the past, they were able to develop cognitively compatible questions, which were approved for content by the Administrative Director of NSUHSSNA.

Finally, the investigators developed questions from a goal directed task analysis of the simulation. A goal directed task analysis involves defining the major goals, sub goals and decisions of the simulation experience (Endsley, 2000).

The investigators scored each participant’s answer to each question as either met or not met. The Hypotension Situation Awareness: SAGAT questions can be found in Appendix C.

- Major goal will be hemodynamic stability
- Major subgoal to be aware of steadily decreasing blood pressure and increasing heart rate
- Major decision to treat blood pressure by opening fluids, administering vasopressors intravenous push or infusion, decreasing volatile agent, placing patient in Trendelenburg, starting additional IV, placing arterial line, considering causes such as vagal stimulation, vascular compression, blood loss and/or anaphylaxis.

Implementation of the SAGAT tool occurred during the simulation experience. Endsley (2000) also has recommendations for implementation that the investigators followed. Recommendations for implementation of the SAGAT tool include explaining the procedures to the subjects prior to testing to avoid any surprise (Endsley, 2000). Additionally, Endsley (2000) suggests informing the subjects to attend to their tasks as they normally would, and if they do not know an answer to a question to make their best guess. Investigators should score answers to queries as either met or not met with a predetermined margin of error (Endsley, 2000).
investigators determined that they would allow a 10% margin of error in perception of vital signs at the freeze. For example, if the subject stated that the blood pressure was 103/64 when it was really 100/60, then that was considered a correct SA perception. Finally, the investigators adhered to Endsley’s (2000) guideline that no freeze would occur earlier than 5 minutes from the start of the simulation and no two freezes will occur within 1 minute of each other.

**Hypotension Situation Awareness: Situation Awareness Global Assessment Technique (SAGAT) Implementation.** Prior to beginning the simulation, each participant was individually pre-briefed by Karen Kapanke CRNA, MS, Assistant Director of the NorthShore School of Nurse Anesthesia. Karen explained the simulation scenario outside of the simulation room then guided each participant into the simulation room. See Appendix E for simulation pre-brief. The participants waiting to do the simulation waited in the GCSI waiting room to ensure they did not speak to the participants who had completed the simulation. During each individual simulation scenario, investigator Caitlin Pierchala used the Hypotension Situation Awareness: Situation Awareness Global Assessment Technique (SAGAT) to assess the SA of the NATs. The first freeze with questions (Appendix C) occurred 5 minutes from the beginning of the simulation. During the freeze, the participant was asked to come out of the simulation room. The participant was then asked to answer the Hypotension Situation Awareness: SAGAT questions and their answers were documented verbatim.

Following completion of the simulation, the participants from group A were asked to fill out the demographic and acceptability surveys (Appendix B). To maintain anonymity, Julia Feczko CRNA, DNP, a NSUHSSNA faculty member distributed the surveys to each participant to ensure the investigators were not present.
The participants from group B, who completed the simulation prior to the seminar, completed the demographic and acceptability surveys after the completion of the situation awareness seminar. Primary investigator Jamie Natale distributed these surveys after the completion of the situation awareness seminar, left an envelope for the surveys to be collected and then left the room. The envelope was then collected after all participants had completed the surveys.

The demographic information that was collected in the Acceptability Survey (Appendix B) was on a separate piece of paper than the Acceptability Survey and each was collected in a separate envelope, therefore the investigators were unable to match the demographic information with the Acceptability Survey responses.

**Acceptability Survey.** The Acceptability Survey (Appendix B) was adapted from The Acceptability e-scale survey developed by Tariman and colleagues. It was used because it had been previously deemed reliable and valid with an alpha coefficient of 0.757 (Tariman et al., 2011). Due to the small sample size, demographic information (Appendix B) completed for this survey was on a separate piece of paper from the Acceptability Survey (Appendix B) and returned in two separate envelopes to ensure that participant’s demographic information could not be connected to their specific survey responses. Group A completed the acceptability survey and demographic survey immediately following their individual simulation experiences. Group B completed the acceptability and demographic survey immediately following their situation awareness seminar. To ensure de-identification, no investigators were present with the NATs while they filled out the surveys; all surveys were collected in two envelopes: one marked Acceptability Survey and one marked Demographic Survey

**Data Analysis**
Data from the Acceptability Survey (Appendix B) was entered into the Statistical Software for the Social Sciences (SPSS) software; Version 23, and analyzed using descriptive and inferential statistics. Specifically, the statistical tests used to analyze the Acceptability Survey (Appendix B) were frequencies, means and standard deviations. The data collected from the Hypotension Situation Awareness: SAGAT questions (Appendix C) were entered in the Statistical Software for the Social Sciences (SPSS), Version 23, and analyzed using descriptive statistics. Specifically, the statistical tests to analyze the SAGAT questions (Appendix C) were Frequencies and Fischer’s Exact Test. Data from the Demographic Survey (Appendix B) was entered in to the Statistical Software for the Social Sciences and analyzed using descriptive statistics.

**Ethics and Human Subjects Protection**

The investigators adhered to the Institutional Review Board requirement for protection of human subjects (U.S. Department of Health and Human Services [HHS], 2010). The investigators both completed Collaborative Institute Training Initiative (CITI) program courses with modules on various ethical research topics such as Ethics of Human Subjects Research, Privacy and Confidentiality, Vulnerable Populations and Conflicts of Interest Involving Human Subjects. All efforts were made by the investigators to maintain a positive educational environment for the participants (CITI Program, 2014).

**Chapter IV: Results**

**Demographic and Acceptability Survey Results**

Eight students attended the seminar and all of the participants completed the survey for a 100% response rate. The majority of the students were white (75%) females (87.5%), between
the ages of 30-39 (62.5%) and had greater than five years of ICU experience (50%) prior to starting the NorthShore University HealthSystem Nurse Anesthesia program. 100% of the participants had prior knowledge of situation awareness, however 62.5% of the participants had not received prior training in situation awareness. Further statistical analysis of this survey and a table exhibiting the demographic information can be found in Appendix H.

The acceptability survey questions were answered on a Likert scale from 1 to 5. The data was entered into SPSS Version 23 and descriptive statistics analyzed. The following descriptive statistical analysis and a chart containing the numerical information can be found in Appendix H. The question “How easy was the content of this seminar to understand?” scored a mean of 4.63, with a standard deviation of 0.744 indicating that the participants found the seminar easy to understand. The question “How much did you enjoy this situation awareness seminar?” scored a mean value of 4.5, with a standard deviation of .0756, indicating that the participants enjoyed the situation awareness seminar very much. The question “How much did you enjoy this simulation?” scored a mean value of 4, with a standard deviation of 0.756, indicating that the participants enjoyed the simulation but not as strongly as they enjoyed the seminar.

Group A was asked questions about how the seminar helped prepare them for their simulation experience. The question “How helpful to you was this seminar to prepare you to apply situation awareness skills in the simulation?” scored a mean value of 4.5, with a standard deviation of 0.577 indicating that the seminar helped them very much to apply their situation awareness skills in the simulation. The question for group B only “How helpful would it have been to have the seminar prior to the simulation to help prepare you to apply situation awareness skills in the simulation?” scored a mean value of 4.25, with a standard deviation of 0.957, indicating that the participants thought the seminar would have been helpful to prepare them to
apply their situation awareness skills during the simulation. The question “How would you rate your overall satisfaction with this seminar?” scored a mean value of 4.88, with a standard deviation of 0.354, indicating that the participants were very satisfied with the situation awareness seminar. The question “Was the amount of time it took to complete this program acceptable?” scored a mean value of 4.88, with a standard deviation of 0.354, indicating that the time to complete the program was very acceptable. Finally, the question “How understandable were the Situation Awareness Global Assessment Technique questions?” scored a mean value of 4.5, with a standard deviation of 0.756, indicating that the SAGAT questions were easy to understand. Descriptive statistical analysis of this data and a chart containing the numerical information can be found in Appendix H.

**Situation Awareness Global Assessment Technique (SAGAT) Questions Results**

The SAGAT question responses were recorded on a data sheet as the verbatim responses given by the participants. These verbatim responses had to be converted to a nominal measurement of *met or not met*. Thus, both of the primary investigators independently scored the SAGAT responses as either *met* or *not met* within the predetermined 10% margin of error. The nominal scores of *met* or *not met* from the SAGAT questions were entered into SPSS software, Version 23, to analyze reliability. The Cronbach’s Alpha score of 0.933 and Average Measures Intraclass Correlation of 0.932 indicated inter-rater reliability between the scoring of the SAGAT surveys by the two primary investigators.

Frequencies were run on the individual SAGAT questions to determine the participant’s percentage of *met* versus *not met* answers for each question. Under the questions related to perception: 75% of the participants correctly answered what the patient’s blood pressure was, 87.5% answered the current heart rate correctly and 50% correctly answered the current ETCO$_2$. 
With regard to questions relating to comprehension, 62.5% of the participants answered the question about the adequate perfusion of the patient correctly. 100% of the participants correctly answered the cause of the current vital signs. 100% of the students answered the three projection questions correctly. The projection questions inquired about what would happen to the blood pressure if the condition did not improve, what further investigation or assessment may be required, and what further medication may be necessary. Further statistical analysis of this data and a chart containing the numerical information can be found in Appendix H.

Frequencies were also run on the SAGAT questions that pertained to each level of SA as a whole (perception, comprehension and projection) and the percentage of met and not met responses for each. For SA Level 1 - perception, 70.8% of the participant’s answers were considered met while 29.2% were not met. For SA Level 2 - comprehension, 81.3% of the participant’s responses were considered met while 18.8% were considered not met. Finally, under the level of projection, 100% of the responses met the predetermined answers. Over all three levels, the participant’s responses were considered met 84.4% of the time while 15.6% of responses were considered not met. Further statistical analysis of this data and a chart containing the numerical information can be found in Appendix H.

Next, cross tabulations between groups A and B and their corresponding responses were run on the SAGAT. The primary investigators analyzed individual SAGAT question’s cross tabulations using the Fischer’s Exact test, utilizing the two-sided significance value to compare to an alpha of <0.05. The first three questions, which were related to perception, and the first comprehension question, all had Fischer’s Exact test scores greater than 0.05. The subsequent questions relating to comprehension and projection were scored as met by all participants in both groups A and B; therefore, no further statistics were computed. Further statistical analysis of this
data and a chart containing the numerical information can be found in Appendix H. The results were not significant and the null hypothesis was accepted for data analysis of the individual SAGAT question responses. Further statistical analysis of this data and a chart containing the numerical information can be found in Appendix H.

From the SAGAT frequencies, the primary investigators noted that most of the not met responses were from the perception category. Therefore, cross tabulations were run on SAGAT question levels 1-3 (perception, comprehension, and projection) versus met or not met. The Likelihood ratio was used to analyze this cross tabulations. The Likelihood ratio was 11.058 with a 2-tailed significance of 0.004, which is less than the level of significance 0.05. Therefore, the null was rejected which concludes that there was an association between the level of situation awareness question and whether or not the response was met or not met. Further statistical analysis of this data and a chart containing the numerical information can be found in Appendix H.

Chapter V: Discussion

The investigator’s clinical questions were successfully answered through the implementation of the situation awareness seminar and simulation. The clinical questions were

- Was there a difference in situation awareness during high fidelity simulation between NATs who attended a SA seminar and NATs who did not?
- How did NATs perceive the situation awareness seminar?

Both of the questions were answered through the acceptability survey and SAGAT questions. Overall, The investigators did not appreciate a statistically significant difference between group A and group B during the simulation related to whether or not they received the seminar first. However, there was correlation between the level of situation awareness and the possibility of
answering the question correctly or not. Additionally, the investigators did receive positive feedback from the participants relating to their experience.

**SAGAT Questions**

Each of the participants agreed to answer the SAGAT questions following the simulation. The SAGAT questions had three questions relating to perception, two questions involving comprehension and three questions concerning projection. Overall, the participants scored highly on the comprehension and projection questions while the perception questions were most commonly missed.

The comprehension question “Is the patient adequately perfused?” seemed to be unclear to the participants. The confusion related to this question may have been due to its brevity. It was noted that many of the participants asked for this question to be repeated before providing an answer. Because this was a research study and the interactions between the participants and investigators had to remain consistent, the investigators were unable to provide further information. Despite this finding, the majority of the participants answered this question correctly.

Interestingly, the most basic, level 1 SA information was more commonly missed while the higher levels of SA were correctly answered. This correlates with the research done by Sitterding et al. (2012) who found that the majority of SA errors occur at, or could be traced back to, the perception level, despite the fact that it was the most basic level. A major strength of this study was to correlate our findings with the findings of Sitterding et al. (2012). Strong Level 1 SA skills are essential for error prevention. Therefore, further research, intervention and training relating to the level of perception may benefit NATs in their development of situation awareness skills.
Group A, who had received the lecture before the simulation, had less overall **not met** responses than group B. The seminar may have proven to be beneficial in preparing the NATs for the SA simulation despite the lack of statistical significance found. The end tidal CO$_2$ (ETCO$_2$) was most commonly missed between both groups with a 50% response rate of **met** and 50% **not met**. This may be due to limited experience monitoring ETCO$_2$ in their previous background as an ICU nurse. The NATs involved in this research only had a limited amount of time in the clinical area specifically performing anesthesia prior to this seminar and simulation. Therefore, this finding is not entirely surprising as this patient parameter is commonly assessed and measured in anesthesia but not as commonly in intensive care nursing.

**Demographic and Acceptability Surveys**

Each of the participants enrolled in the study answered the demographic and acceptability surveys in their entirety. The sample size of 8 was adequate for the purposes of the investigator’s pilot study. The age of the participants and years of ICU experience did not have a bearing on the results of the SAGAT questions or acceptability. There was not a similar ratio of male to female participants as there are in the NSUHSSNA Class of 2017. However, there are not gender differences in situation awareness skills of nurses, so this should not have an effect on the SAGAT scores.

The results of the acceptability survey revealed primarily positive and favorable feedback from the participants relating to their experience with the SA seminar and simulation. All questions scored a mean value of >4.0 and a standard deviation of <1.0. The high mean score with a narrow standard deviation indicates overall favorability of the simulation and seminar. The lowest mean score was that group B did not think it would have been helpful to have the SA seminar prior to the simulation. A greater percentage of participants who enjoyed the seminar
more than the simulation, which is not surprising as simulations can bring feelings of nervousness and uncertainty. Overall, the acceptability survey was a dependable format for evaluating the effectiveness of the SA seminar and simulation.

A pilot study is a valuable component of research, which allows researchers to evaluate the sustainability of the planned study, ensure feasibility of a larger scale proposed research process, avoid problems that may arise when a large scale study is conducted and guides the research plan (Doody & Doody, 2015). The favorable responses on the Acceptability survey and the correlation of findings with other research on situation awareness in nursing demonstrate that this study design is sustainable and feasible on a larger scale. One problem that arose during the study was that participants often answered the SAGAT questions in the form of a range, such as “the heart rate is 70-80’s” as opposed to “the heart rate is 75”. Thus, to avoid this problem in future studies, the participants should be instructed to not give answers in the form of a range.

One aspect deemed favorable by the participants and primary investigators was the amount of time it took to complete the study. There was a streamlined flow of participants through all points of the research study, including the seminar, waiting area of GCSI, pre-briefing, simulation and de-briefing. The effective flow of the day was maintained because one member of the research team (primary investigators, committee members or school faculty) was responsible for the objectives at each point and then directed participants to their next location. This allowed multiple aspects of the study to be occurring at the same time.

**Chapter VI: Limitations**

The sample size was small and served as a pilot study with convenience sample. This occurred because the study was limited to one cohort of NSUHSSA trainees; therefore, the findings may not be generalizable to overall NAT population. The entire class of 2017 was
invited to participate in the study, however only 8 students consented to participate. Future studies with a larger sample size would be useful to fully examine differences between group A and group B and acceptability of the study.

Another limitation of this study was that the principle investigators were also students at NSUHSSA; the 2017 cohort may have felt obligated to participate in the study. The participants may also have evaluated the study more positively than they would have otherwise because the investigators were fellow students. To try to minimize this bias, the class of 2017 NATs was informed of the voluntary nature of their participation in the seminar and simulation through the Recruitment Email and Information Sheet for Participation in Research Study (Appendix A).

**Chapter VII: Future Recommendations**

Further research is needed to evaluate situation awareness training in nurse anesthesia trainees on a larger scale. Most participants were already familiar with the concept of situation awareness and many had previous training in situation awareness. The content of the seminar could be modified to be more depth rather than an overview of situation awareness in nurse anesthesia. The findings of this study corroborates other research on situation awareness in nursing and suggests that focusing on training at the level of perception has the most potential for improvement in situation awareness skills. In future research, the seminar content should focus on methods to improve perception such as distribution of attention, from both conscious and unconscious control and managing sensory input. Seminar content should also focus on the cycle of working memory and aspects of long-term memory, such as automacity. For example, automaticity seminars could have participants perform the sequence of induction as a simulation, then evaluate the nurse anesthesia trainee and monitor for advances in situation awareness over
time. This type of research study could evaluate the effect of repetition on the NAT and how they advance or transform through evaluation of several identical simulations.

After evaluating the SAGAT survey responses, which were frequently answered in the form of a range, the investigators appreciated the need for a single response to questions. In the future, the investigators would recommend instructing participants to respond in concrete, single answers and rejecting an answer in the form of a range, specifically relating to blood pressure, heart rate and ETCO$_2$ in the perception category. Additionally, for the comprehension and projection questions, asking participants to give their single, best answer as opposed to several would assist in streamlining the scoring of the SAGAT questions.

Another interesting observation was the visual assessment of the interventions taken by the participants during the simulation. For example, as the some of participants perceived a decline in vitals signs, they responded by opening the fluids, administering a vasopressor, decreasing the volatile anesthetic and asking about blood loss. Other participants did not act upon the declining vital signs. In the study by Cooper, Kinsman, Buykx, McConnell-Henry, Endacott, and Scholes (2010), an expert observer assessed a Skills Performance of the participants from a predetermined list of clinical actions or observations during the simulation and then also assessed situation awareness skills during a pause of the simulation. In future research, the Skills Performance assessment could be done during the simulation to further evaluate the situation awareness of participants.

It might be beneficial for the simulated vital signs to be outside the typical range at the end of time simulation to ensure the participants were not answering with the most instinctive values. Lastly, the investigators would advise to reword the SAGAT question about the patient’s perfusion, as many of the participants were confused about what the question was asking. The
question could be written as “Are the patient’s vital signs, specifically the blood pressure, adequate to perfuse their body?”

Chapter VIII: Conclusion

The goals of this study were successfully met through the implementation of this project. The investigators speculated if education on situation awareness would be beneficial to the novice anesthesia provider. The acceptability survey found that the participants felt that the seminar was helpful.

The investigators answered the clinical questions set forth at the beginning of the DNP project research process through the implementation of the SAGAT questions and acceptability survey. The investigators did not find a significant difference between group A and group B during the simulation and through the results of the SAGAT questions. However, there was a statistically significant association between the level of situation awareness question and whether or not the response was met or not met. That finding correlates with other research on Situation Awareness in nursing. The results of the acceptability survey demonstrated a favorable response of the seminar and simulation from the participants. This provides preliminary evidence on the benefits of situation awareness education to NATs, but more studies are needed.
References


APPENDIX A

Recruitment Email & Information Sheet for Participation in Research Study
Recruitment Email

Dear Nurse Anesthesia Trainee of the Class of 2017,

We would like to invite you to participate in our situation awareness seminar and simulation as part of our DNP Scholarly Leadership Project on December 14th, 2015. The goal of this project is to evaluate situation awareness in nurse anesthesia trainees (NAT) after implementation of a seminar and high fidelity simulation. Your participation is voluntary. If at any time during the seminar or simulation you decide not to participate, simply exit. Once you submit a survey, however, we will be unable to remove your data from the acceptability survey because all data is de-identified and confidential. The total time commitment for each participant will be a maximum of 2 hours.

Attached you will find an information sheet for participation in a research study. Please review prior to your participation in the situation awareness seminar, simulation and completion of the acceptability survey.

Thank you for your time,

Jamie Natale and Caitlin Pierchala
EVALUATING SITUATION AWARENESS

INFORMATION SHEET FOR PARTICIPATION IN RESEARCH STUDY

Evaluating Situation Awareness in the Nurse Anesthesia Trainee During High Fidelity Simulation

Principal Investigator: Caitlin Pierchala RN, BSN and Jamie Natale RN, BSN

Institution: DePaul University, USA

Faculty Advisors: Pamela Schwartz, CRNA, DNP. Administrative Director NorthShore University HealthSystem
Karen Kapanke, CRNA, MS. Assistant Director NorthShore University HealthSystem

Collaborators: Pamela Schwartz, CRNA, DNP. Administrative Director NorthShore University HealthSystem
Julia Feczko, CRNA, DNP. Staff NorthShore University HealthSystem

We are conducting a research study because we are trying to learn more about the effectiveness and acceptability of situation awareness seminar by evaluation situation awareness of nurse anesthesia trainees during high fidelity simulation. We are asking you to be in the research because you are a nurse anesthesia trainee enrolled at NorthShore University HealthSystem. If you agree to be in this study, you will be asked to attend a situation awareness seminar, participate in a high fidelity simulation and complete an acceptability survey. The situation awareness seminar will include information on situation awareness in nursing and anesthesia. The survey will include demographic questions along with questions about how you accepted the situation awareness seminar. The high fidelity simulation will take place at the Grainger Center for Simulation and Innovation. We will also collect some personal information about you such as your gender, age group, and number of years as an ICU nurse. If there is a question you do not want to answer, you may skip it.

This study will take about 2 hours of your time. Research data collected from you will be de-identified and confidential.

Your participation is voluntary, which means you can choose not to participate. There will be no negative consequences if you decide not to participate or change your mind later after you begin the study. You can withdraw your participation at any time, including the seminar and simulation, prior to submitting your survey. If you change your mind later while answering the
survey, you may simply exit the survey. Once you submit a survey, however, we will be unable to remove your data from the acceptability survey because all data is de-identified and confidential. Your decision whether or not to be in the research will not affect your job or employment at NorthShore University HealthSystem. Information collected in this survey will be confidential and locked in the office of Pam Schwartz CRNA, DNP. The only people who will have access to the information will be the primary investigators of this study.

You must be age 18 or older to be in this study. This study is not approved for the enrollment of people under the age of 18.

If you have questions, concerns, or complaints about this study or you want to get additional information or provide input about this research, please contact Caitlin Pierchala, RN BSN at 847-421-9016 or email at cpierchala@gmail.com or Jamie Natale, RN, BSN at 708-207-0896 or email at Jamie.natale30@gmail.com

If you have questions about your rights as a research subject you may contact Susan Loess-Perez, DePaul University’s Director of Research Compliance, in the Office of Research Services at 312-362-7593 or by email at sloesspe@depaul.edu. You may also contact DePaul’s Office of Research Services if:

- Your questions, concerns, or complaints are not being answered by the research team.
- You cannot reach the research team.
- You want to talk to someone besides the research team.
Appendix B: Surveys

Acceptability Survey
Demographic Survey
ACCEPTABILITY SURVEY
1. How easy was the content of this seminar to understand?
   1-very difficult
   2
   3
   4
   5- easy to understand

2. How much did you enjoy this situation awareness seminar?
   1-not at all
   2
   3
   4
   5- very much

3. How much did you enjoy this simulation?
   1-not at all
   2
   3
   4
   5- very much

4a. **Group A only**: How helpful to you was this seminar to prepare you to apply situation awareness skills in the simulation?
   1-very unhelpful
   2
   3
   4
   5- very helpful

4b. **Group B only**: How helpful would it have been to have the seminar prior to the simulation to help prepare you to apply situation awareness skills in the simulation?
5. How would you rate your overall satisfaction with this seminar?
   1-very dissatisfied
   2
   3
   4
   5- very satisfied

6. Was the amount of time it took to complete this program acceptable?
   1-very unacceptable
   2
   3
   4
   5- very acceptable

7. How understandable were the Situation Awareness Global Assessment Technique questions?
   1-difficult to understand
   2
   3
   4
   5-easy to understand
DEMOGRAPHIC INFORMATION SURVEY

1. What is your gender?
   Male
   Female

2. What is your age group?
   20-29
   30-39
   40-49
   50-59
   60 and above

3. What is your ethnic origin?
   White
   Hispanic/Latino
   Black/African American
   Native American/American Indian
   Asian Pacific Islander
   Other
   Prefer not to answer

4. How many years of ICU experience did you have before starting anesthesia school?
   <1 year
   1-3 years
   4-5 years
   >5 years

5. Have you heard of Situation Awareness as prior to today?
   Yes
   No

6. Have you had any Situation Awareness training prior to today?
   Yes
   No
Appendix C

Hypotension Situation Awareness:

Situation Awareness Global Assessment Technique (SAGAT) Questions
**Major Goal:** Hemodynamic stability

**Major Sub goal:** To be aware of steadily decreasing blood pressure and increasing heart rate

**Major Decision:** To treat blood pressure by opening fluids, administering vasopressors either IVP or infusion, decreasing volatile anesthetic, placing patient in Trendelenburg, starting additional IV, placing arterial line and/or considering causes such as vagal stimulation, vascular compression, blood loss, and/or anaphylaxis

<table>
<thead>
<tr>
<th>Question</th>
<th>Acceptable response</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the patient’s current blood pressure?</td>
<td>Within 10% of actual</td>
</tr>
<tr>
<td>What is the patient current heart rate?</td>
<td>Within 10% of actual</td>
</tr>
<tr>
<td>What is the patient's current EtCO2?</td>
<td>Within 10% of actual</td>
</tr>
<tr>
<td>Is the patient adequately perfused?</td>
<td>No</td>
</tr>
<tr>
<td>What could be causing the current vital signs?</td>
<td>Hypovolemia, bleeding, vagal stimulation, too high sevoflurane dosage, anaphylaxis, vascular compression</td>
</tr>
<tr>
<td>If the condition does not improve, what will happen to the blood pressure?</td>
<td>The blood pressure will continue to decrease</td>
</tr>
<tr>
<td>What further investigation/assessment may be required?</td>
<td>How much fluid has the patient received? Or How much blood is in the suction? Or Ask the surgeon if they are compressing on any vasculature</td>
</tr>
<tr>
<td>What further medication may be required?</td>
<td>Any vasopressors or additional fluids (crystalloids or colloids)</td>
</tr>
</tbody>
</table>
Appendix D

Timeline of Events
<table>
<thead>
<tr>
<th></th>
<th><strong>Group A</strong></th>
<th><strong>Group B</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Situation awareness seminar</td>
<td>30 minutes</td>
<td>Simulation:</td>
</tr>
<tr>
<td>Simulation:</td>
<td>8 minutes</td>
<td>Pre briefing</td>
</tr>
<tr>
<td>Pre briefing</td>
<td>minute 0</td>
<td>Scenario begin</td>
</tr>
<tr>
<td>Scenario begin</td>
<td>minute 1</td>
<td>Pause/SAGAT queries</td>
</tr>
<tr>
<td>Pause/SAGAT queries</td>
<td>minute 5</td>
<td>Scenario end</td>
</tr>
<tr>
<td>Scenario end</td>
<td>minute 6</td>
<td>Debriefing</td>
</tr>
<tr>
<td>Debriefing</td>
<td>minutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7-8</td>
<td>Situation awareness seminar</td>
</tr>
</tbody>
</table>
Appendix E

Simulation
Simulation

After the participant has been pre-briefed outside of the simulation operating room, the SAGAT questioner will bring them into the operating room.

**SAGAT Questioner to Participant:** “I am going to give you a quick report on your patient before we start the simulation. This is a 44-year-old female undergoing an open abdominal hysterectomy. She has no significant medical history other than heavy vaginal bleeding and abdominal wall mass. Surgical history includes a lap cholecystectomy in 2012 without any adverse events. Home medications include multi-vitamins and Iron. She did have a bowel prep yesterday for this procedure. She does not smoke/drink/use illicit drugs. She has a right hand 18g IV with Lactated Ringer's infusing. She is type and crossed for 2 units of PRBCs. She is a mallampati 1, easy to mask ventilate and congratulations, you just successfully intubated her! Sevoflurane is at 2.2% and she currently has 0/4 twitches on train of four. Any medications you should need are here (points to tray table with prefilled medication syringes). The patient already received Ancef 2 g IV. Please treat the patient as you normally would, but please narrate your actions so we all know what you are doing. Do you have any questions? Take a few seconds to orient yourself to the situation and when you are ready we will begin.”

**Current vital signs:** HR 75, RR 10, BP 130/75, Sat 100%, EtCO2 35

**Simulation begins:** Surgeon and Scrub tech drape patient and hand drapes to participant.

**Surgeon calls time out:** “Before incision we will do a time out. This is patient Jane Doe, she has no known allergies, she is here for an open abdominal hysterectomy. We have all of our equipment and no surgical concerns. She received Ancef 2 grams for antibiotic prophylaxis. Any concerns?” (Surgeon waits for response) “Ok let’s begin. Incision.”

**120 seconds into simulation vital signs:** HR 80, RR 10, BP 91/40, Sat 100%, EtCO2 32

**240 seconds into simulation vital signs:** HR 85, RR 10, BP 85/46, Sat 100%, EtCO2 30

**300 seconds into simulation vital signs:** HR 92, RR 10, BP 82/45, Sat 99%, EtCO2 29

**SAGAT questioner at 5 mins:** “Ok simulation is paused, please turn around
APPENDIX F

International Review Board (IRB) Approval Letters
October 22, 2015

Caitlin Pierchala, RN, BSN
Department of School of Anesthesia
2650 Ridge Ave.
Evanston, IL 60201


Dear Ms. Pierchala:

The above-referenced project was reviewed in the Research Institute and by a member of the Third Friday Institutional Review Board (IRB) of NorthShore University HealthSystem. This project was approved on the date of this letter and has IRB approval through 10/21/2016.

The project was reviewed in accordance with the Code of Federal Regulations (45 CFR 46 - as revised). The NorthShore University HealthSystem Institutional Review Board has an approved assurance of compliance with OHRP which covers this activity (Federal Wide Assurance: FWA00003000). This project conforms to the requirements for exemption from the Code of Regulations because Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods [45 CFR 46.101(1)].

Because there will be in-person interaction with the study subject, a final version of the Consent Form that must be used for this study is enclosed. **You are required to keep the original signed Consent Forms in your files.**

According to institutional policy, your project must be reviewed every two years. A Progress Report Form (RI-5.0) will be due in the Research Institute no later than 45 days prior to the above expiration date. **Changes in the experimental protocol must not occur without prior approval of the IRB.** Unanticipated problems must be reported to the IRB. If this project is terminated before its next Review, please submit a Termination Report Form (RI-5.1) to the Research Institute.

Sincerely yours,

Sara Levin, MSN, RN-BC
Chairperson, Institutional Review Board

lk

cc: Schwartz, Pamela, RN
    Robert Stanton, J.D.
To: Caitlyn Pierchala, BSN, Graduate Student, School of Nursing  
Date: November 10, 2015  
Re: Research Protocol # CP092915NUR  
“Evaluating Situation Awareness in the Nurse Anesthesia Trainee During High Fidelity Simulation”

Please review the following important information about the review of your proposed research activity.

Review Details  
This submission is an initial submission.

Your research project meets the criteria for Exempt review under 45 CFR 46.101 under the following category:

(1) Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

Approval Details  
Your research was originally reviewed on October 12, 2015 and October 30, 2015, and revisions were requested. The revisions you submitted on November 9, 2015 were reviewed and approved on November 10, 2015.

Number of approved participants: 20 Total  
You should not exceed this total number of subjects without prospectively submitting an amendment to the IRB requesting an increase in subject number.

Funding Source: 1) None.

Approved Performance sites: 1) DePaul University; 2) NorthShore University Healthsystem, Evanston Hospital.

Reminders  
- Under DePaul’s current institutional policy governing human research, research projects that meet the criteria for an exemption determination may receive administrative review by the Office of Research Services.
Services Research Protections staff. Once projects are determined to be exempt, the researcher is free to begin the work and is not required to submit an annual update (continuing review). As your project has been determined to be exempt, your primary obligation moving forward is to resubmit your research materials for review and classification/approval when making changes to the research, but before the changes are implemented in the research. All changes to the research must be reviewed and approved by the IRB or Office of Research Services staff. Changes requiring approval include, but are not limited to, changes in the design or focus of the research project, revisions to the information sheet for participants, addition of new measures or instruments, increasing the subject number, and any change to the research that might alter the exemption status (either add additional exemption categories or make the research no longer eligible for an exemption determination).

- Once the project is complete, you should submit a final closure report to the IRB.

The Office of Research Services would like to thank you for your efforts and cooperation and wishes you the best of luck on your research. If you have any questions, please contact me by telephone at (312) 362-6168 or via email at jbloom8@depaul.edu.

For the Board,

Jessica Bloom, MPH
Research Protections Coordinator
Office of Research Services

Cc: Jamie Natale, BSN, Co-Investigator, Graduate Student, School of Nursing
    Pamela Schwartz, DNP, Faculty, School of Nursing
    Julie Feczko, CRNA, Faculty, School of Nursing
APPENDIX G

Consent Form
CONSENT FORM
Evaluating Situation Awareness in the Nurse Anesthesia Trainee During High Fidelity Simulation

Principal Investigator: Caitlin Pierchala RN, BSN
Principal Investigator telephone number: (847) 421 9016
Sponsor: None

EXPLANATION OF STUDY:
Introduction: You are being asked to volunteer for this research study because you are a nurse anesthesia trainee enrolled at NorthShore University HealthSystem. This study will attempt to determine if situation awareness is a good way to help nurse anesthesia trainees learn about anesthesia concepts. This study will also help us to learn how to improve situation awareness skills in nurse anesthesia trainees. There are three levels of situation awareness: perception, comprehension and projection.

This Consent Form gives information about the study to help your decision whether you wish to participate or not. If you have any questions, you can ask the study investigators or their academic advisors, Julia Feczko CRNA, DNP or Pamela Schwartz CRNA, DNP.

Why is this Study Being Done?
This study is being done to determine if using situation awareness helps nurse anesthesia trainees perform better when doing a high fidelity simulation.

This study will include a total of 12 subjects, all of which will be from NorthShore University HealthSystem (NorthShore).

What Will Happen During the Study?
You will arrive at your normal classroom, Burch G-18, at NorthShore University HealthSystem and if you agree to be in this study, you will be divided into two groups, A and B. Participants will be divided into two groups by selecting numbers. Even numbers will be group A (2, 4, 6, 8, 10,12) and odd numbers will be group B (1, 3, 5, 7, 9, 11). If more than 12 students consent to participate in the study, numbers 13-20 will not be enrolled in the study do to time constraints. However, numbers 13-20 will be invited to attend the situation awareness lecture so that they are not excluded from the opportunity to learn about situation awareness. Students enrolled in the study will be asked to attend a situation awareness seminar, about 30 minutes in length, that will explain the concept of situation awareness and its place in nursing and anesthesia. Students enrolled in the study will also be asked to participate in a high fidelity simulation. The high fidelity simulation will take place at the Grainger Center for Simulation and Innovation. This experience will simulate a hypotensive situation and will last approximately 8 minutes. Immediately after the simulation, primary
investigator Caitlin Pierchala will directly ask you questions relating to the simulation. Then, you will be offered time to debrief on the simulation. Group A will attend the situation awareness seminar before the high fidelity simulation. In contrast, Group B will participate in the high fidelity simulation and then attend the situation awareness seminar.

After you participate in the simulation and seminar, you will complete an acceptability survey. The survey will be anonymous and it will take about 10 minutes to complete. The survey will ask general information about you such as your gender, age group, and number of years as an ICU nurse. If there is a question you do not want to answer, you may skip it. Numbers 13-20 will not be enrolled in the study due to time constraints; they will not complete an Acceptability Survey, nor the simulation nor the Hypotension Situation Awareness SAGAT questions.

**How Long Will I Be In the Study?**
This study will take about 90 minutes of your time. This is a one time participation. Research data collected from you will be anonymous and only the investigators will have access to that information.

**What Other Choices Do I Have?**
This is a research study and does not involve treatment. The alternative is not to participate.

**Are There Benefits to Taking Part in the Study?**
There will be no direct benefit to you if you decide to participate in this study. You may indirectly benefit by feeling that you are helping future nurse anesthesia trainees to learn more effectively and improve their learning experiences during high fidelity simulation. You may find that your participation leads to gaining knowledge of situation awareness skills in anesthesia and this may benefit you in your future practice.

**What Side Effects or Risks Can I Expect?**
Your participation does not involve any physical risk or emotional risk to you.

**Will I Be Paid for Participating?**
You will not be paid for being in this study. As a student enrolled in the NorthShore University HealthSystem School of Nurse Anesthesia, you can park in the West Ryan Field lot as you normally do on class days.

**Will There Be Additional Costs?**
There is expected to be no cost to you from being in this research study.

**Can I Withdraw From the Study?**
Your participation in this research study is voluntary. No matter what decision you make, there will be no penalty to you. You may stop participating in the seminar, high fidelity simulation, or acceptability survey at any time.

**Will I Be Informed of New Information About the Study?**
Any significant new information that may affect your participation will be given to you as soon as it becomes available.
What Are My Rights as a Research Subject?
You may get more information about your rights from the Chairperson of the Institutional Review Board (IRB). You can also call the IRB Coordinators at 224/364-7100. These are the people you should contact about any problems or research-related injuries that happen during the research study.

By participating in this research study you do not waive any rights to which you would normally be entitled.

Who Can I Call With Questions?
If you have questions at any time during the study, you may contact the Principal Investigator, Caitlin Pierchala, at telephone: (847) 421-9016 or email, cpiерchala@gmail.com. You may also contact the Other Investigator, Jamie Natale, at telephone: (708) 207-0896 or email Jamie.natale30@gmail.com. You may also contact the faculty advisor, Julia Feczko, at telephone: (773) 627-6468 or email jfeczko@northshore.org. You may also contact another faculty advisor, Pamela Schwartz, at telephone: (847)570-1958 or email pschwartz@northshore.org.

INDIVIDUAL PROVIDING EXPLANATION: Caitlin Pierchala

The procedures and/or investigations described in the above paragraphs have been explained to you by:

| Name of Person Explaining Study (Please PRINT) |  |
| Signature of Person Explaining Study |  |
| Date Study Was Explained |  |

CONSENT TO PARTICIPATE:
I understand that the Principal Investigator and study staff will supervise the study. I have read this consent form or have had it read to me. I understand what will happen if I enroll in this research study. I understand the possible benefits and risks of the study. I give permission for the research study procedures described in this consent form.

I have reviewed this information with the study doctor and/or staff. I have had enough time to talk about all of my questions and concerns. I willingly consent to be a part of this study. I will receive a signed and dated copy of this Consent Form.

| Subject’s Name (Please PRINT) |  |
| Subject’s Signature |  |
| Date Subject Signed |  |
APPENDIX H
Statistical analysis of Acceptability and Demographic Surveys

Demographic Table
Acceptability Table
SAGAT Frequency Table
SAGAT Crosstabs Table
<table>
<thead>
<tr>
<th>Table 2. Acceptability of the Study Participants</th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>How easy was the content of this seminar to understand? 1-very difficult 2 3 4 5- easy to understand</td>
<td>4.63</td>
<td>0.744</td>
</tr>
<tr>
<td>How much did you enjoy this situation awareness seminar? 1-not at all 2 3 4 5- very much</td>
<td>4.5</td>
<td>0.756</td>
</tr>
<tr>
<td>How much did you enjoy this simulation? 1-not at all 2 3 4 5- very much</td>
<td>4</td>
<td>0.756</td>
</tr>
<tr>
<td>Group A only: How helpful to you was this seminar to prepare you to apply situation awareness skills in the simulation? 1-very unhelpful 2 3 4 5- very helpful</td>
<td>4.5</td>
<td>0.577</td>
</tr>
<tr>
<td>Group B only: How helpful would it have been to have the seminar prior to the simulation to help prepare you to apply situation awareness skills in the simulation? 1-very unhelpful 2 3 4 5- very helpful</td>
<td>4.25</td>
<td>0.957</td>
</tr>
<tr>
<td>How would you rate your overall satisfaction with this seminar? 1-very dissatisfied 2 3 4 5- very satisfied</td>
<td>4.88</td>
<td>0.354</td>
</tr>
<tr>
<td>Was the amount of time it took to complete this program acceptable? 1-very unacceptable 2 3 4 5- very acceptable</td>
<td>4.88</td>
<td>0.354</td>
</tr>
<tr>
<td>How understandable were the Situation Awareness Global Assessment Technique questions? 1-difficult to understand 2 3 4 5- easy to understand</td>
<td>4.5</td>
<td>0.756</td>
</tr>
<tr>
<td>Demographics of the Study Participants</td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td>---------------------------------------</td>
<td>-----------</td>
<td>---------</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>1</td>
<td>12.5%</td>
</tr>
<tr>
<td>Female</td>
<td>7</td>
<td>87.5%</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>3</td>
<td>37.5%</td>
</tr>
<tr>
<td>30-39</td>
<td>5</td>
<td>62.5%</td>
</tr>
<tr>
<td><strong>Ethnic Origin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>6</td>
<td>75%</td>
</tr>
<tr>
<td>Asian Pacific Islander</td>
<td>2</td>
<td>25%</td>
</tr>
<tr>
<td><strong>ICU experience in Years</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3 years</td>
<td>1</td>
<td>12.5%</td>
</tr>
<tr>
<td>4-5 years</td>
<td>2</td>
<td>37.5%</td>
</tr>
<tr>
<td>&gt;5 years</td>
<td>4</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Prior Knowledge of SA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>8</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Prior Training in SA</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>3</td>
<td>37.5%</td>
</tr>
<tr>
<td>No</td>
<td>5</td>
<td>62.5%</td>
</tr>
</tbody>
</table>
### Table 4. SAGAT Frequencies

<table>
<thead>
<tr>
<th>Perception</th>
<th>Frequency</th>
<th>% Met</th>
<th>% Not Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>What is the patient’s current BP</td>
<td>Met: 6</td>
<td>75</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Not met: 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the patient’s current HR?</td>
<td>Met: 7</td>
<td>87.5</td>
<td>12.5</td>
</tr>
<tr>
<td></td>
<td>Not met: 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What is the patient’s current ETCO₂?</td>
<td>Met: 4</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Not met: 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehension</td>
<td>Met: 5</td>
<td>62.5</td>
<td>37.5</td>
</tr>
<tr>
<td></td>
<td>Not met: 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>What could be causing the</td>
<td>Met: 8</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>current vital signs?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projection</td>
<td>Met: 8</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>If the condition does not</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>improve, what will happen to the</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>vital signs?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>What further investigation/assessment may be required?</td>
<td>Met: 8</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>What further medication may be</td>
<td>Met: 8</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>required?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 5. SAGAT Crosstabs

<table>
<thead>
<tr>
<th>Perception</th>
<th>Group</th>
<th># Met</th>
<th># Not Met</th>
<th>Fischer’s Exact Test (2-sided)</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is the patient’s current BP</strong></td>
<td>Group A (seminar first)</td>
<td>4</td>
<td>0</td>
<td>0.429</td>
<td>Not significant, null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>Group B (simulation first)</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What is the patient’s current HR?</strong></td>
<td>Group A (seminar first)</td>
<td>4</td>
<td>0</td>
<td>1.000</td>
<td>Not significant, null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>Group B (simulation first)</td>
<td>3</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What is the patient’s current ETCO₂?</strong></td>
<td>Group A (seminar first)</td>
<td>2</td>
<td>2</td>
<td>1.000</td>
<td>Not significant, null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>Group B (simulation first)</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Comprehension</strong></td>
<td>Group A (seminar first)</td>
<td>3</td>
<td>1</td>
<td>1.000</td>
<td>Not significant, null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>Group B (simulation first)</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What could be causing the current vital signs?</strong></td>
<td>Group A (seminar first)</td>
<td>4</td>
<td>0</td>
<td></td>
<td>All participants answered correctly, no further data to compute, null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>Group B (simulation first)</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Projection</strong></td>
<td>Group A (seminar first)</td>
<td>4</td>
<td>0</td>
<td></td>
<td>All participants answered correctly, no further data to compute, null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>Group B (simulation first)</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What further investigation/assessment may be required?</strong></td>
<td>Group A (seminar first)</td>
<td>4</td>
<td>0</td>
<td></td>
<td>All participants answered correctly, no further data to compute, null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>Group B (simulation first)</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>What further medication may be required?</strong></td>
<td>Group A (seminar first)</td>
<td>4</td>
<td>0</td>
<td></td>
<td>All participants answered correctly, no further data to compute, null hypothesis accepted</td>
</tr>
<tr>
<td></td>
<td>Group B (simulation first)</td>
<td>4</td>
<td>0</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix I: Proof of Training

CITI Training Certificates
FCOI Certificate of Completion
COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COURSEWORK TRANSCRIPT REPORT**

** NOTE: Scores on this Transcript Report reflect the most current quiz completions, including quizzes on optional (supplemental) elements of the course. See list below for details. See separate Requirements Report for the reported scores at the time all requirements for the course were met.

- **Name:** Caitlin Pierchala (ID: 4560851)
- **Email:** cpierechala@gmail.com
- **Institution Affiliation:** DePaul University (ID: 1435)
- **Phone:** 8474219016
- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course
- **Report ID:** 14811047
- **Report Date:** 12/26/2014
- **Current Score**: 91

<table>
<thead>
<tr>
<th>REQUIRED, ELECTIVE, AND SUPPLEMENTAL MODULES</th>
<th>MOST RECENT</th>
<th>SCORE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students in Research</td>
<td>12/19/14</td>
<td>8/10 (80%)</td>
</tr>
<tr>
<td>History and Ethical Principles - SBE</td>
<td>12/19/14</td>
<td>4/5 (80%)</td>
</tr>
<tr>
<td>Defining Research with Human Subjects - SBE</td>
<td>12/19/14</td>
<td>4/5 (80%)</td>
</tr>
<tr>
<td>The Federal Regulations - SBE</td>
<td>12/20/14</td>
<td>5/5 (100%)</td>
</tr>
<tr>
<td>Assessing Risk - SBE</td>
<td>12/20/14</td>
<td>5/5 (100%)</td>
</tr>
<tr>
<td>Informed Consent - SBE</td>
<td>12/20/14</td>
<td>5/5 (100%)</td>
</tr>
<tr>
<td>Privacy and Confidentiality - SBE</td>
<td>12/20/14</td>
<td>5/5 (100%)</td>
</tr>
<tr>
<td>Conflicts of Interest in Research Involving Human Subjects</td>
<td>12/20/14</td>
<td>5/5 (100%)</td>
</tr>
<tr>
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COLLABORATIVE INSTITUTIONAL TRAINING INITIATIVE (CITI PROGRAM)
COURSEWORK REQUIREMENTS REPORT*

* NOTE: Scores on this Requirements Report reflect quiz completions at the time all requirements for the course were met. See list below for details. See separate Transcript Report for more recent quiz scores, including those on optional (supplemental) course elements.

- **Name:** Caitlin Pierchala (ID: 4560851)
- **Email:** cpierechala@gmail.com
- **Institution Affiliation:** DePaul University (ID: 1435)
- **Phone:** 847/219/016

- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course
- **Report ID:** 14811047
- **Completion Date:** 12/20/2014
- **Expiration Date:** 12/19/2017
- **Minimum Passing:** 80
- **Reported Score**: 91

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- **Name:** Caitlin Pierchala (ID: 4560851)
- **Email:** cpierchala@gmail.com
- **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
- **Phone:** 8474219016
- **Curriculum Group:** Basic/Refresher Course - Human Subjects Research
- **Course Learner Group:** Biomedical Research
- **Stage:** Stage 1 - Basic Course
- **Report ID:** 16665398
- **Completion Date:** 07/15/2015
- **Expiration Date:** 07/14/2017
- **Minimum Passing:** 80
- **Reported Score**: 89

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<td>Avoiding Group Harms - U.S. Research Perspectives (ID:14080)</td>
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- **Name:** Caitlin Pierchala (ID: 4560851)
- **Email:** cpierchala@gmail.com
- **Institution Affiliation:** NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
- **Phone:** 3474219016
- **Curriculum Group:** Basic/Refresher Course - Human Subjects Research
- **Course Learner Group:** Biomedical Research
- **Stage:** Stage 1 - Basic Course
- **Report ID:** 16665398
- **Report Date:** 07/15/2015
- **Current Score:** 94

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- **Name:** Jamie Natale (ID: 4560233)
- **Email:** jamie.natale30@gmail.com
- **Institution Affiliation:** DePaul University (ID: 1435)
- **Phone:** 7082070896
- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course
- **Report ID:** 14806891
- **Completion Date:** 12/18/2014
- **Expiration Date:** 12/17/2017
- **Minimum Passing:** 80
- **Reported Score:** 82

### REQUIRED AND ELECTIVE MODULES ONLY

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- **Name:** Jamie Natale (ID: 4560233)
- **Email:** janie.natale30@gmail.com
- **Institution Affiliation:** DePaul University (ID: 1435)
- **Phone:** 708-207-0896
- **Curriculum Group:** Students
- **Course Learner Group:** Students - Class projects
- **Stage:** Stage 1 - Basic Course
- **Report ID:** 14806891
- **Report Date:** 08/05/2015
- **Current Score**: 90

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- Name: Jamie Nateal (ID: 4560233)
- Email: pschwartz@northshore.org
- Institution Affiliation: NorthShore University HealthSystem Research Institute - Evanston, IL (ID: 1050)
- Phone: 7082070896

- Curriculum Group: Basic/Refresher Course - Human Subjects Research
- Course Learner Group: Students - Class projects
- Stage: Stage 1 - Basic Course

- Report ID: 16788258
- Completion Date: 08/02/2015
- Expiration Date: 08/01/2017
- Minimum Passing: 80
- Reported Score*: 95

REQUIRED AND ELECTIVE MODULES ONLY

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- **Report Date:** 08/05/2015
- **Current Score**: 90

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- **Web:** https://www.citiprogram.org
This certificate is awarded to

**Caitlin Pierchala**

for the successful completion of the course

**Financial Conflicts of Interest in Research - 528016**

*By NorthShore*

Date: 7/29/2015
This certificate is awarded to

Jamie Natale

for the successful completion of the course

Financial Conflicts of Interest in Research - 528016

By NorthShore

Date: 8/5/2015
Appendix J

*DNP Committee Approval Form*
VI: Final approval Form

DePaul University
School of Nursing
Doctor of Nursing Practice Program

DNP Evidence-Based Scholarly Leadership Project
Final approval Form

DNP Student Name: Caitlin Pierschala and Jamie Natale

DNP Scholarly Leadership Project Title: Evaluating Situation Awareness in the Nurse Anesthesia Trainer During High Fidelity Simulation

The Evidence-Based Scholarly Leadership Project is designed as a clinical scholarship project allowing students to demonstrate synthesis and mastery of an advanced specialty within nursing practice. The project integrates the various role of the DNP in a comprehensive health care environment that includes utilization of leadership, consultation, advocacy, and collaboration and in depth work with experts from nursing and other disciplines.

By the completion of the DNP program, the student must complete the project, culminating in a presentation of the project. Following the final presentation, this form must be signed to verify successful completion of the project. The DNP project committee chair will forward the signed form to the School of Nursing program Director.

DNP Scholarly Leadership Project Final Approval

[Signature]
DNP Committee Chair Signature

[Signature]
Committee Member Signature

[Signature]
Committee Member Signature

Date